CLAIMS

What is claimed is:

1. A system comprising:
a generator to generate electrical power;
a DC storage or source device (DCSSD);
a power bus coupled to said generator; and
a bi-directional conversion unit coupled between said power bus and said DCSSD, said bi-directional conversion unit capable of transitioning between a first direction wherein electrical power flows from said power bus to said DCSSD and a second direction wherein electrical power flows from said DCSSD to said power bus.

2. The system of claim 1, wherein said DCSSD is a battery.

3. The system of claim 2, wherein electrical power demanded by a load is supplied by at least one of said generator and said battery via said power bus.

4. The system of claim 2, wherein electrical power demanded by a load is supplied by said power bus without an interruption during transitioning of said bi-directional conversion unit from said first direction of power flow to said second direction of power flow.

5. The system of claim 2, wherein, when the generator is actively generating electrical power, battery power is used to compensate for drop in the voltage level of the power bus, to provide power to a load without interruption, at least in one of the following situations: (1) when load demand increases, (2)

when the power bus is experiencing a load surge and (3) when said generator is being driven at low RPM.

6. The system of claim 1, further comprising an AC inverter coupled to receive DC power from said power bus and convert said DC power into AC power.

7. The system of claim 5, wherein electrical power generated by said generator supplies AC load when the AC inverter is turned and any remaining power that the AC load does not require is used to recharge said battery.

8. The system of claim 1, wherein said bi-directional conversion unit operates in said first direction of power flow when the voltage level of the power bus exceeds an upper threshold value and operates in said second direction of power flow when the voltage level of the power bus drops below a lower threshold value, said upper threshold value set a defined value below the power bus voltage level maintained when the generator is actively generating power.

9. The system of claim 1, further comprising a processor, based at least in part on the voltage level of the power bus, controls the direction of electrical power flowing through said bi-directional conversion unit between said DCSSD and the power bus.

10. The system of claim 1, wherein said bi-directional conversion unit further comprises a bi-directional circuit having switching elements, and a controller to generate control signals to selectively activate switching elements of said bi-directional circuit to control the direction and the amount of electrical power flowing through said bi-directional circuit between said DCSSD and the power bus.

11. The system of claim 2, further comprising a thermal sensor located at the battery to provide battery temperature information, wherein a battery charge current supplied to recharge the battery is regulated according to the battery temperature information.

12. The system of claim 1, further comprising a generator drive coupled between the generator and the power bus, said generator drive capable of adjusting the output power of the generator.

13. The system of claim 12, further comprising a rotational speed sensor coupled to said generator and output therefrom is input to a processor, wherein said processor controls the output power generated by the generator via the generator drive to match the electrical power supplied to loads.

14. The system of claim 13, wherein said processor is configured to determined if the generator is capable of producing sufficient power to match the power demanded by the loads, wherein if the current generator rotational speed is inadequate to meet the load demand, the processor is configured to send control signals to vary the speed of a drive device supplying mechanical force to the generator.

15. A power generation system comprising:

a generator to generate an electrical power;

an electronic control unit coupled to said generator, said electrical control unit containing a power supply bus; and

a bi-directional conversion unit coupled to power bus to control flow of electrical power to and from said power bus.

16. The power generation system of claim 15, wherein said electronic control unit further comprises a generator drive to selectively adjust the power produced by the generator

17. The power generation system of claim 15, wherein said bi-directional conversion unit comprising a bi-directional power supply circuit coupled between said power bus and a battery, said bi-directional power supply circuit capable of transitioning between a first direction wherein electrical power flows from said power bus to a battery and a second direction wherein electrical power flows from said battery to said power bus.

18. The power generation system of claim 15, wherein said electrical control unit further comprises an AC inverter coupled to receive DC power from said power bus and convert said DC power into AC power.

19. The power generation system of claim 18, further comprising a battery pack coupled to said bi-directional conversion unit, wherein electrical power generated by said generator supplies AC load and any remaining power that the AC load does not require is used to recharge said battery pack.

20. The power generation system of claim 19, wherein, when the generator is actively generating electrical power, battery power stored in said battery pack is used to compensate for drop in the voltage level of the power bus, to provide power to a load without interruption, at least in one of the following situations: (1) when load demand increases, (2) when the power bus is experiencing a load surge and (3) when said generator is being driven at low RPM.

21. The power generation system of claim 15, which includes the ability to derive power from both said generator and said battery pack to prevent AC voltage brownouts when power devices that require high levels of temporary power.

22. The power generation system of claim 15, which includes an idle control that sets the vehicle's idle speed, working in conjunction with said inverter charger unit such that when high power levels is demanded, additional power is derived from said battery pack via the bi-directional power supply, eliminating sudden application of torque by said generator and thus eliminating engine RPM fluctuations.

23. The power generation system of claim 15, further comprising a thermal sensor for monitoring the temperature of the batteries in said battery pack, and adjust the recharge voltage level established in said inverter charger unit such that the batteries are recharged in an optimal way to extend said battery pack life and maximum amount of stored charge.

24. A method comprising:

generating electrical power;

charging a power bus using the electrical power generated;

charging a battery using the electrical power from said power bus if voltage level of said power bus exceeds an upper threshold value; and

charging said power bus using the electrical power from said battery if the voltage level of said power bus drops below a lower threshold value.

25. The method of claim 24, further comprising adjusting the electrical power generated if load demand exceeds the electrical power generated and the electrical power supplied by the battery.

26. The method of claim 25, wherein said electrical power is generated by a generator which is driven by an engine,

27. The method of claim 26, further comprising adjusting said electrical power generated by operating said generator by varying AC voltage level applied to generator stator coils while maintaining optimum slip in order to maintain the power bus within a defined voltage range.

28. The method of claim 26, further comprising adjusting said electrical power generated by adjusting the speed of the engine driving the generator in order to maintain the power bus within a defined voltage range.

29. The method of claim 24, further comprising providing AC and DC electrical power simultaneously.

30. A system comprising:

at least one electrical power storage device;

at least one electrical power source device;

at least one load; and

a power supply controller coupled between said at least one electrical storage device and said at least one electrical source device to control the flow of electrical energy between said storage device and said source device and to control the flow of electrical energy demanded by said at least one load from at least one of said storage and source devices.

31. The system of claim 30, wherein said at least one electrical storage device is a battery and said at least one electrical source device is a generator.

32. The system of claim 30, wherein said at least one load comprises AC load and DC load.

33. The system of claim 32, wherein said power supply controller provided electrical energy to AC load and DC load simultaneously supplied by one of said storage and source devices.

34. The system of claim 30, wherein said power supply controller comprises a power bus and a bi-directional conversion unit capable of transitioning between a first direction wherein electrical power flows from said power bus to said at least one electrical storage device and a second direction wherein electrical power flows from said at least one electrical storage device to said power bus.